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(54) **Press brake**

Biegepresse

Presse plieuse

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(73) Proprietor: **Liet, Cornelis Hendricus**
NL-7581 PJ Losser (NL)

(72) Inventor: **Liet, Cornelis Hendricus**
NL-7581 PJ Losser (NL)

(74) Representative: **Voncken, Bartholomeus Maria Ch.**
De Vries & Metman,
Overschiestraat 180
1062 XK Amsterdam (NL)

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Description

[0001] The invention relates to a press brake comprising folding tools that can be fitted in a movable beam by means of a receiving and clamping arrangement, which receiving and clamping arrangement consists at least of recesses formed in said beam for accommodating the folding tools, a clamping plate being pivotable about a pivot axis, which clamping plate has an end intended to engage the tools present in said recesses, and which comprises a number of resilient lips arranged side by side and separated from each other by cuts extending from the edge of the end of the clamping plate, and a driving arrangement engaging said clamping plate, which functions to cause the clamping plate to pivot about its pivot axis, wherein the end of the clamping plate that engages the folding tools and the point of engagement of the driving arrangement are located on opposite sides of the pivot axis. Such a press brake is known from US-A-6003360.

[0002] Because in a press brake of this type the end of the clamping plate that engages the folding tools and the point of engagement of the driving arrangement are located on opposite sides of the pivot axis, it is possible to keep the distance between said end of the clamping plate and the pivot axis very small. Like this it is possible to minimise the distortion (torsion) of the clamping plate when the clamping plate is asymmetrically loaded (for example when folding tools are not provided along the entire length of the beam in the recesses thereof). This is of importance, because otherwise the end of the clamping plate would engage the folding tools in an irregular way, or even part of the folding tools would not be engaged at all by the clamping plate.

[0003] It is an object of the present invention to improve a press brake of the type referred to in the introduction.

[0004] In view of the above the invention provides a press brake comprising folding tools that can be fitted in a movable beam by means of a receiving and clamping arrangement, which receiving and clamping arrangement consists at least of recesses formed in said beam for accommodating the folding tools, a clamping plate being pivotable about a pivot axis, which clamping plate has an end intended to engage the tools present in said recesses, and which comprises a number of resilient lips arranged side by side and separated from each other by cuts extending from the edge of the end of the clamping plate, and a driving arrangement engaging said clamping plate, which functions to cause the clamping plate to pivot about its pivot axis, wherein the end of the clamping plate that engages the folding tools and the point of engagement of the driving arrangement are located on opposite sides of the pivot axis, and whereby from the centre of the clamping plate outwardly successive cuts enclose an ever increasing angle with the perpendicular to said edge of the clamping plate in such a manner, that the cuts mutually converge in a direction from said edge towards said pivot axis.

[0005] Whereas all cuts of a known press brake of the present type extend in parallel to the said perpendicular of the clamping plate (thus perpendicularly to said edge), such that it cannot be avoided completely that lips present between successive cuts experience different deformations and an optimal clamping of the folding tools cannot be guaranteed, the positioning of the cuts according to the present invention results in such a shape of the resilient lips, that these all engage the folding tools at their ends with a substantially equal clamping force.

[0006] In a preferred embodiment the distance between adjacent cuts at said edge remains substantially unchanged.

[0007] Due to this measure the operation of the press brake can be optimised further.

[0008] Moreover it is suggested, that the cuts extend substantially up to the pivot axis. As a result the lips obtain an optimal resilience.

[0009] In correspondence with another preferred embodiment of the press brake according to the invention, the pivot axis is defined by a shoulder of a housing mounted on the beam for accommodating at least part of the driving arrangement and a counter shoulder on the clamping plate, whereas the shoulder and counter shoulder are shaped in such a manner that in the clamping position of the clamping plate a surface contact occurs there between for receiving reaction forces caused by the clamping force and driving force. The said surface contact prevents that damage occurs at the cooperating parts of the shoulder and counter shoulder as a result of the high reaction forces which may be generated during the operation of the press brake.

[0010] When, in accordance with another preferred embodiment of the press brake according to the invention, in the clamping position of the clamping plate the play between the side ends of the clamping plate and the housing is at most 0,5 mm, and preferably is in the magnitude of 0,1 mm, it can be prevented that the clamping plate will assume an inclined position (that means that one of its ends lies at a higher level than its other end). Such an inclined position of the clamping plate would lead to irregularly clamping the folding tools. By now minimising the play between the side ends of the clamping plate and the housing such an undesired effect can be avoided.

[0011] The invention will be explained in more detail below with reference to the drawing, which shows an embodiment of the press brake according to the invention.

Figure 1 is a schematic cross-sectional view of a part of the press brake according to the invention; and figure 2 is a schematic front view of a clamping plate used in the press brake according to the invention.

[0012] The press brake according to the invention comprises a movable beam 1, as is already known per se, in which recesses 2 for receiving folding tools 3 are

formed. The folding tools 3 can be used for folding sheet material, such as a metal sheet.

[0013] The folding tools 3 are detachably fitted in the beam 1. After all, it must be possible to adjust the folding tools 3 with respect to the beam 1 (in a direction perpendicular to the plane of the drawing) to move the folding tools 3 at least partially or to exchange at least some of the folding tools for other folding tools. In the illustrated embodiment the folding tools comprise a transverse pin 4 which engages in a corresponding recess 5 of the beam 1. When the receiving and clamping arrangement to be described hereinafter has released the folding tools, these folding tools 3 can be shifted with their transverse pin 4 in the recess 5 of the beam 1 in a direction perpendicular to the plane of the drawing, until the folding tools 3 can be taken away sidewards from the beam 1.

[0014] In order to effect the mentioned detachability of the folding tools 3 with respect to the beam 1, use is made of a receiving and clamping arrangement which, as far as the most essential parts thereof are concerned, comprises, apart from the recesses 2 and the combination of transverse pin 4 and recess 5, also a pivotable clamping plate 6 and a driving arrangement engaging the clamping plate 6, which driving arrangement in this case consists of compression springs 7 and a driving unit 8.

[0015] The clamping plate 6 has an end 9 intended for engaging the folding tools 3 that are accommodated in the recesses 2. Said end 9 is thereto provided with a nose 10, which can mate with a corresponding cut out 11 in the folding tools 3.

[0016] The clamping plate 6 has a shoulder 12 at a point some distance away from the aforesaid end 9, which shoulder rests on a counter shoulder 13 of a housing 14 mounted to the beam 1. As a result of the mating interaction of the shoulders 12 and 13, a pivot axis for the clamping plate 6 is formed at that location, which pivot axis extends over the entire width of the clamping plate 6, perpendicularly to the plane of drawing in figure 1.

[0017] The compression springs 7, a number of which are arranged side by side perpendicularly to the plane of drawing, load the clamping plate to a pivoted position (as shown) in which the nose 10 engages the cut-out 11 of the folding tools, so that the folding tools 3 are pressed firmly into the recesses 2 and upwards against the beam 1. When the driving unit 8 (e.g. a cylinder-piston assembly) is activated, the clamping plate 6 can be pivoted against the force exerted by the compression springs 7 to a position (not shown) in which the clamping nose 10 releases the recesses 11, and the folding tools 3 can be removed in downward direction, as seen in figure 1, from the beam 1. In the illustrated embodiment the point of engagement of the compression springs 7 with the clamping plate 6 is located below the point of engagement of the driving unit 8 (thus closer to the pivot axis). As a result, when activating the driving unit 8 a moment is created which promotes the movement of the clamping plate 6 towards its release position.

[0018] By only activating the driving unit 8 to a small extend the folding tools 3 are not fully released, however a shift thereof relative to the beam 1 perpendicular to the plane of drawing is possible.

[0019] Because the driving arrangement 7, 8 is positioned at the side of the pivot axis facing away the end 9, as appears clearly from figure 1, the distance between this pivot axis (as defined by the shoulders 12 and 13) and the end 9 can be minimised. Thus possible torsions (for example when the clamping plate 4 is asymmetrically loaded) are limited.

[0020] Now referring to figure 2, the clamping plate 6 as applied in the press brake illustrated in figure 1 is again visible. The location of the pivot axis has been indicated by a twin dotted line 15. The circles 7' schematically indicate the location where in this case two compression springs 7 engage the clamping plate 6. At a central position the driving unit 8 has been indicated in dotted lines.

[0021] As appears clearly from figure 2, the end 9 of the clamping plate 6 engaging the folding tools is provided with cuts 16. One can see directly, that from the centre of the clamping plate (dotted line 17) outwardly successive cuts 16 enclose an ever increasing angle with the perpendicular to the edge 18 of the clamping plate 6 (this perpendicular runs in parallel to the indicated dotted line 17). The cuts 16 converge in a direction from the edge 18 towards the pivot axis 15.

[0022] The positioning of the cuts is such, that the distance between adjacent cuts 16 at the edge 18 of the clamping plate 6 remains substantially unchanged. Further it appears clearly from figure 2 that the cuts extend substantially up to the pivot axis 15.

[0023] Figure 2 further partially shows the beam 1, which beam 1 comprises mounting arrangements 19 for the housing 14. For giving room to said mounting arrangements 19 the clamping plate 6, comprises corresponding cut-outs 20 at its side ends. In this particular case the distance x between the inner end of each outer cut 16 and the corresponding cut 20 is larger than the distance y between the inner ends of the two innermost cuts 16. This ensures, that at the edges 18 of the lips 21 defined between the cuts 16 substantially equal clamping forces are generated.

[0024] At the left in figure 2 the play z between the clamping plate 6 and the housing 14 (or its mounting arrangement 19) has been indicated (the same applies at the right side). For avoiding an inclined position of the clamping plate 6 this play should be kept as small as possible, for example 0,5 mm (or even in the magnitude of 0,1 mm).

[0025] Finally, again referring to figure 1, it is visible that in the represented clamping position of the clamping plate 6 (in which the compression springs 7 have moved the upper end of the clamping plate 6 to the right, while the driving unit 8 is not activated) a surface contact exists between the clamping plate 6 and the housing 14 in the areas immediately adjacent (partly below and partly aside) the location of engagement between the shoulder 12 and counter shoulder 13. As a result of such a surface

contact (in contrast to a line contact) the reaction forces as a result of the forces generated by the compression springs and the clamping force at the nose 10 can be accommodated without the risk of damaging the clamping plate 6 or the housing 14.

[0026] The invention is not limited to the embodiment as described above, which can be varied widely within the scope of the invention as defined in the claims.

Claims

1. Press brake comprising folding tools (3) that can be fitted in a movable beam (1) by means of a receiving and clamping arrangement, which receiving and clamping arrangement consists at least of recesses (2) formed in said beam (1) for accommodating the folding tools (3), a clamping plate (6) being pivotable about a pivot axis (15), which clamping plate (6) has an end (9) intended to engage the tools (3) present in said recesses (2), and which comprises a number of resilient lips (21) arranged side by side and separated from each other by cuts (16) extending from the edge (18) of the end (9) of the clamping plate (6), and a driving arrangement (7, 8) engaging said clamping plate (6), which functions to cause the clamping plate (6) to pivot about its pivot axis (15), wherein the end (9) of the clamping plate (6) that engages the folding tools (3) and the point of engagement of the driving arrangement (7, 8) are located on opposite sides of the pivot axis (15), **characterised in that** from the centre (17) of the clamping plate (6) outwardly successive cuts (16) enclose an ever increasing angle with the perpendicular to said edge (18) of the clamping plate (6) in such a manner, that the cuts (16) mutually converge in a direction from said edge (18) towards said pivot axis (15).

2. Press brake according to claim 1, wherein the distance between adjacent cuts (16) at said edge (18) remains substantially unchanged.

3. Press brake according to claim 1 or 2, wherein the cuts (16) extend substantially up to the pivot axis (15).

4. Press brake according to one of the previous claims, in which the pivot axis (15) is defined by a counter shoulder (13) of a housing (14) mounted on the beam (1) for accommodating at least part of the driving arrangement (7,8) and a shoulder (12) on the clamping plate (6), whereas the shoulder (12) and counter shoulder (13) are shaped in such a manner that in the clamping position of the clamping plate (6) surface contact occurs therebetween for receiving reaction forces caused by the clamping force and driving force.

5. Press brake according to claim 4. wherein in the clamping position of the clamping plate (6) the play between the side ends of the clamping plate and the housing is at most 0,5 mm.

6. Press brake according to claim 5, wherein in the clamping position of the clamping plate (6) the play between the side ends of the clamping plate and the housing is in the magnitude of 0,1 mm.

7. Press brake according to one of the previous claims, wherein the driving arrangement (7,8) of the clamping plate (6) comprises at least a compression spring (7) and an activatable driving unit (8), such as for example a cylinder-piston assembly, engaging the clamping plate (6) at opposite sides and mutually staggered.

8. Press brake according to claim 7, wherein the compression spring (7) engages the clamping plate (6) closer to the pivot axis (15) then the driving unit (8).

Patentansprüche

1. Abkantpresse mit Faltwerkzeugen (3), die mittels einer Aufnahme- und Klemmanordnung in einen bewegbaren Träger (1) eingepasst werden können, welche Aufnahme- und Klemmanordnung zumindest aus Ausnehmungen (2), die in dem Träger (1) zur Unterbringung der Faltwerkzeuge (3) ausgebildet sind, einer Klemmplatte (6), die um eine Schwenkachse (15) schwenkbar ist, welche Klemmplatte (6) ein Ende (9) aufweist, das für den Eingriff mit den in den Ausnehmungen (2) vorhandenen Werkzeugen (3) bestimmt ist und welches eine Anzahl von federnden Lippen (21) aufweist, die nebeneinander angeordnet und durch Ausschnitte (16) voneinander getrennt sind, die sich von dem Rand (18) des Endes (9) der Klemmplatte (6) erstrecken, und einer Antriebsanordnung (7, 8) besteht, die in die Klemmplatte (6) eingreift, um diese um ihre Schwenkachse (15) zu schwenken, wobei das Ende (9) der Klemmplatte (6), das in die Faltwerkzeuge (3) eingreift, und die Stelle des Eingriffs der Antriebsanordnung (7, 8) an gegenüberliegenden Seiten der Schwenkachse (15) liegen, **dadurch gekennzeichnet, dass** von der Mitte (17) der Klemmplatte (6) nach außen aufeinanderfolgende Ausschnitte (16) einen immer größer werdenden Winkel mit der Senkrechten zu dem Rand (18) der Klemmplatte (6) derart einschließen, dass die Ausschnitte (16) in einer Richtung von dem Rand (18) zu der Schwenkachse (15) hin gegenseitig konvergieren.

2. Abkantpresse nach Anspruch 1, wobei der Abstand zwischen benachbarten Ausschnitten (16) an dem Rand (18) im Wesentlichen unverändert bleibt.

3. Abkantpresse nach Anspruch 1 oder 2, wobei sich die Ausschnitte (16) im Wesentlichen bis zu der Schwenkachse (15) erstrecken.

4. Abkantpresse nach einem der vorhergehenden Ansprüche, wobei die Schwenkachse (15) durch eine Gegenschulter (13) eines Gehäuses (14), das an dem Träger (1) zur Unterbringung zumindest eines Teils der Antriebsanordnung (7, 8) montiert ist, und eine Schulter (12) an der Klemmplatte (6) definiert ist, während die Schulter (12) und die Gegenschulter (13) dergestalt sind, dass in der Klemmposition der Klemmplatte (6) ein Flächenkontakt zwischen diesen zum Aufnehmen von Reaktionskräften auftritt, die durch die Klemmkraft und die Antriebskraft verursacht werden.

5. Abkantpresse nach Anspruch 4, wobei in der Klemmposition der Klemmplatte (6) das Spiel zwischen den seitenenden der Klemmplatte und dem Gehäuse maximal 0,5 mm ist.

6. Abkantpresse nach Anspruch 5, wobei in der Klemmposition der Klemmplatte (6) das Spiel zwischen den Seitenenden der Klemmplatte und dem Gehäuse in der Größenordnung von 0,1 mm ist.

7. Abkantpresse nach einem der vorhergehenden Ansprüche, wobei die Antriebsanordnung (7, 8) der Klemmplatte (6) zumindest eine Druckfeder (7) und eine aktivierbare Antriebseinheit (8), wie zum Beispiel eine Zylinder-Kolbenanordnung, aufweist, die in die Klemmplatte (6) an gegenüberliegenden Seiten eingreifen und gegeneinander versetzt sind.

8. Abkantpresse nach Anspruch 7, wobei die Druckfeder (7) näher zu der Schwenkachse (15) als die Antriebseinheit (8) in die Klemmplatte (6) eingreift.

Revendications

1. Presse plieuse contenant des outils de pliage (3) qui peuvent être montés dans une poutre mobile au moyen d'un agencement de réception et de bridage, lequel agencement de réception et de bridage consiste en au moins des évidements (2) formés dans ladite poutre (1) pour loger les outils de pliage (3), une plaque de bridage (6) étant pivotante autour d'un axe de pivot (15), laquelle plaque de bridage (6) présente une extrémité (9) destinée à coopérer avec les outils présents dans lesdits évidements (2), et qui comprend un certain nombre de lèvres élastiques (21) disposées côte à côte et séparées l'une de l'autre par des découpes (16) s'étendant à partir du bord (10) de l'extrémité (9) de la plaque de bridage (6) et un agencement d'entraînement (7, 8) coopérant avec ladite plaque de bridage (6), dont l'action est de provoquer le pivotement de la plaque de bridage (6) autour de son axe de pivotement (15), dans lequel l'extrémité (9) de la plaque de bridage (6) qui coopère avec les outils de pliage (3) et le point d'engagement de l'agencement d'entraînement (7, 8) sont situés sur les côtés opposés de l'axe de pivotement (15), **caractérisée en ce qu'**à partir du centre (17) de la plaque de bridage (6), des découpes successives vers l'extérieur (16) incluent un angle sans cesse croissant par rapport à la perpendiculaire audit bord (18) de la plaque de bridage (6), de manière que les découpes (16) convergent mutuellement dans une direction à partir dudit bord (18) vers ledit axe de pivotement (15).

2. Presse plieuse selon la revendication 1, dans laquelle la distance entre les découpes contiguës (16) sur ledit bord (18) demeure sensiblement inchangée.

3. Presse plieuse selon la revendication 1 ou 2, dans laquelle les découpes (16) s'étendent sensiblement jusqu'à l'axe de pivotement (15).

4. Presse plieuse selon l'une des revendications précédentes, dans laquelle l'axe de pivotement (15) est défini par un contre-épaulement (13) d'un logement monté sur la poutre (1) pour recevoir au moins une partie de l'agencement d'entraînement (7, 8) et un épaulement (12) sur la plaque de bridage (6), tandis que l'épaulement (12) et le contre-épaulement (13) sont configurés de telle sorte que, dans la position de bridage de la plaque de bridage (6), il se produit un contact de surface entre ceux-ci pour recevoir les forces de réaction résultant de la force de bridage et de la force d'entraînement.

5. Presse plieuse selon la revendication 4, dans laquelle, dans la position de bridage de la plaque de bridage (6), le jeu entre les extrémités latérales de la plaque de bridage et du logement est au maximum de 0,5 mm.

6. Presse plieuse selon la revendication 5, dans laquelle, dans la position de bridage de la plaque de bridage (6), le jeu entre les extrémités latérales de la plaque de bridage et du logement se situe dans l'ordre de grandeur de 0,1 mm.

7. Presse plieuse selon l'une des revendications précédentes dans laquelle l'agencement d'entraînement (7, 8) de la plaque de bridage (6) comprend au moins un ressort de compression (7) et une unité d'entraînement actionnable (8), telle que par exemple un ensemble cylindre-piston, coopérant avec la plaque de bridage (6) sur des côtés opposés et décalés entre eux.

8. Presse plieuse selon la revendication 7, dans laquel-

le le ressort de compression (7) coopère avec la plaque de bridage (6) plus près de l'axe de pivotement (15) que l'unité d'entraînement (8),

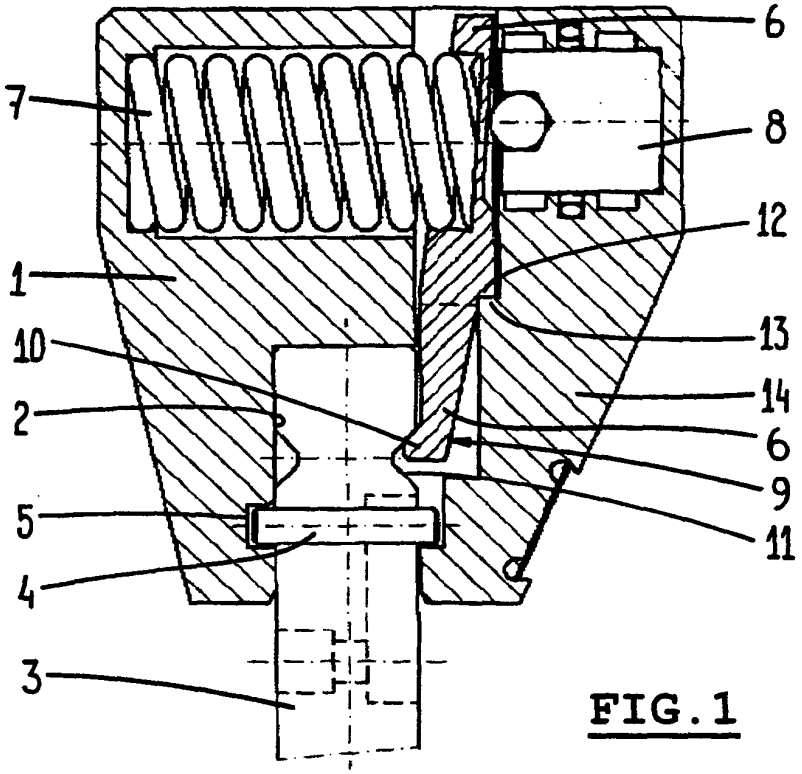

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FIG.1

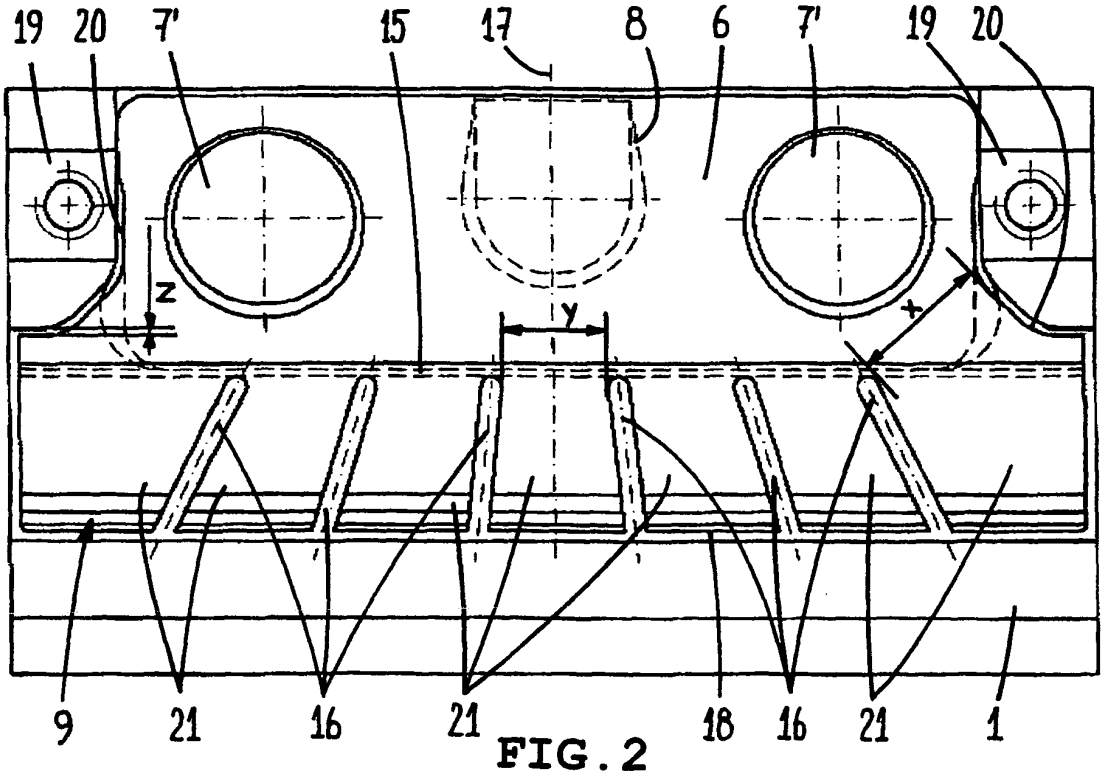

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FIG.2